FLEXIBLESLEEPNET: AUTOMATIC SLEEP STAGE CLASSIFICATION USING MULTI-CHANNEL POLYSOMNOGRAPHY

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Abstract

Sleep stage classification plays a crucial role in the diagnosis and treatment of sleep-related disorders. Traditional manual scoring of polysomnography (PSG) recordings is time-consuming, labor-intensive, and prone to inter-expert variability. In this study, we propose FlexibleSleepNet, a robust and flexible deep learning framework for automatic sleep stage classification using multi-channel polysomnography signals. The proposed model effectively integrates information from multiple physiological modalities, including electroencephalogram (EEG), electrooculogram (EOG), and electromyogram (EMG), to capture both temporal and spatial dependencies inherent in sleep patterns.FlexibleSleepNet employs a hybrid architecture that combines convolutional neural networks for feature extraction with sequence modeling techniques to learn temporal transitions between sleep stages. The model is designed to adapt to varying channel configurations, making it suitable for diverse clinical and real-world settings. Additionally, attention mechanisms are incorporated to enhance the interpretability and focus on relevant physiological features.Extensive experiments conducted on benchmark sleep datasets demonstrate that FlexibleSleepNet achieves superior performance compared to existing state-of-the-art methods in terms of accuracy, F1-score, and robustness. The proposed framework not only reduces the reliance on manual annotation but also provides a scalable and efficient solution for automated sleep analysis. This work contributes to the advancement of intelligent healthcare systems by enabling reliable and flexible sleep stage classification.